4-H Study Materials for Entomology Contests for Juniors (Age 9-11)

January 2003

V. Insect and Arachnid Orders

Class Hexapoda (Insecta)

Insect Characteristics

Most adult insects have:

1. A body divided into three parts (head, thorax and abdomen)

2. Three pairs of legs

3. Usually one pair of antennae and a pair of compound eyes (a few exceptions to these characteristics are found)

4. Usually two pairs of wings (absent in insects such as lice, fleas, ants; flies have one pair of wings)

Insect Orders

The Class Insecta is generally divided into about 30 orders. Many of these orders are of minor importance and are studied only because of scientific interest. Considered here are some of the most important orders likely to be encountered. Many taxonomists (scientists who name organisms) disagree on the number of orders and their names. Thus, this scheme will often vary.

Insect orders are groups of insects that are similar in body structure, type of wing**s**, type of mouthparts, etc., and to some extent, in habits. With approximately 1,000,000 different insect names (species), it is impossible to become familiar with more than a small percentage of them. A fundamental step in insect identification is recognition of order. One should be able to assign nearly all insects to order, with a little study. This placing allows a person to conclude many things about the species from known information about the order.

Each insect order shares a set of characteristic biological and anatomical features. Therefore proper interpretation of mouthparts, leg types, etc., aids in recognition of orders. A good entomologist can recognize common insect orders quickly.

In more advanced entomology, the ability to assign an insect to a family, genus and species becomes necessary. As the insect is assigned to a more precise group, it corresponds more closely to other individuals in that group. Thus, classification helps us become familiar with and organize our knowledge concerning insects. Classification also allows one to use the proper scientific name to correctly look up information about a species (or other group) in a library.

Common Insect Orders

Odonata

Common names: dragonflies and damselflies

Metamorphosis: hemimetabolous

Mouthparts: chewing

Key Characteristics: Odonata are large insects with two pairs of membranous, many-veined wings; the hind pair is as large as or larger than the front pair. They have large conspicuous eyes and bristle-like antennae.

Biology: Young live in water and are not like the adults. Adults are common around ponds, lakes and streams. Both adults and aquatic nymphs feed on insects. They are beneficial, because they feed to some extent on mosquitoes and other small flies. Dragonflies and damselflies can hover like a helicopter or fly and dart around rapidly. They have been called "mosquito hawks" and "snake doctors."

Name derivation: Odonata = Greek word meaning “tooth”

Orthoptera

Common names: grasshoppers, crickets, katydids

Metamorphosis: paurometabolous

Mouthparts: chewing

Key Characteristics: Orthoptera have long antennae and various leg modifications. They generally have two pairs of wings with many veins. The front pair is usually slender and the hind pair is broad and fan-like. Wings are reduced to small pads in some grasshoppers and crickets.

Biology: Nymphs resemble adults. Adults in several groups in this order never develop wings. These include such odd insects as the cave crickets. The order Orthoptera is a large one. Some members of this group are quite destructive to crops (grasshoppers).

Name derivation: Orthoptera = Latin for “straight” (ortho); “wings” (ptera)

Blattaria

Common name: cockroaches

Metamorphosis: paurometabolous

Mouthparts: chewing

Key Characteristics: Blattaria are cursorial (adapted for running) and move rapidly. They have flattened bodies and a head concealed from above by the pronotum. They have two pairs of wings, but in some species the wings are greatly reduced.

Biology: Cockroaches are somewhat general feeders, but prefer materials high in fats and starches. They deposit their eggs in a capsule called an ootheca. Several species invade homes where they can contaminate food. They have an unpleasant odor and can be very annoying.

Name derivation: Blattaria = Greek word meaning “shuns light”

Mantodea

Common name: mantids or preying mantids

Metamorphosis: paurometabolous

Mouthparts: chewing

Key Characteristics: Mantodea are large, elongate and slow-moving insects. Their front legs are greatly modified for grasping prey.

Biology: They are predaceous on a large variety of insects and other arthropods. They usually wait motionless for their prey to venture within striking distance. Mantids are well known as biological control agents. However, they do not distinguish between useful and destructive species, but feed on any insects that come near.

Name derivation: Mantodea = Greek word meaning “soothsayer”

Phasmida

Common names: walkingsticks, leaf insects

Metamorphosis: paurometabolous

Mouthparts: chewing

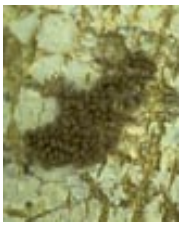
Key Characteristics: Phasmida have elongate bodies.

Biology: Walkingsticks are slow moving and are generally found on trees or shrubs. Walkingsticks are able to regenerate lost legs. These insects have chewing mouthparts and feed on foliage. Our species are wingless as

adults. However, some tropical forms are winged and are called leaf insects.

Name derivation: Phasmida = Latin word meaning “phantom”

Psocoptera



Common names: psocids, booklice, and barklice

Metamorphosis: paurometabolous

Mouthparts: chewing

Key Characteristics: Psocoptera are tiny insects that have either four wings or none at all.

Biology: Booklice are found around old books, papers and in damp, dark rooms. Those with wings are called psocids (pronounced so-sids). Most live out of doors and are found resting in soil litter, around vegetation or on stones, logs and fences. They are rather uncommon but may be locally abundant. Some booklice feed on stored grains while others are library pests. They are microscopic to 1/4 inch in size.

Name derivation: Psocoptera = Latin for rubbed “small” (psoco); “wings” (ptera) (This refers to the gnawing habits of these insects.)

Phthiraptera

Common name: lice

Metamorphosis: gradual

Mouthparts: chewing or sucking

Key Characteristics: Phthiraptera are wingless parasites that live on most birds and mammals. They are small, flat, wingless, parasitic insects with short legs and short antennae. They are about 1/6 to 3/16 inch long when mature. Phthiraptera are divided into two suborders: Mallophaga or chewing lice and Anoplura or sucking lice.

Biology: Chewing lice feed on bits of hair, feathers or skin of the host. Lice deposit their eggs on the hair or feathers of the host. They are important pests of domestic birds and animals, but they do not live on humans.

Sucking lice feed mainly on blood. These insects are found commonly on domestic animals, but not on birds. They feed by sucking blood and are important pests of domestic animals and humans. Eggs are laid on individual hairs and the eggs are called “nits”. The human body louse has been responsible for millions of human deaths through the centuries. They spread the organism causing epidemic typhus from one person to another.

Name derivation: Phthiraptera = “lice” (phthir); “without” (a); “wings” (ptera)

Mallophaga = Latin for “wool” (mallo); “eat” (phaga)

Anoplura = Latin for “unarmed” (anopl); “tail” (ura)

Hemiptera

Common name: bugs or “true bugs”

Metamorphosis: paurometabolous

Mouthparts: piercing-sucking

Key Characteristics: Hemiptera have a beak arising from front of the head, long antennae, and two pairs of wings (in most adults). Hemiptera usually have four wings held flat over the body. The front pair are thickened and leathery at the base with membranous tips or ends and called hemelytra.

Biology: They are found on plants and animals, or in water. Some bugs cause considerable plant damage by their feeding. Some are beneficial because they prey on other insects.

Name derivation: Hemiptera = Lain for “half” (hemi); “wings” (ptera)

Homoptera

Common names: leafhoppers, scale insects, aphids, planthoppers, cicadas, whiteflies, mealybugs

Metamorphosis: paurometabolous

Mouthparts: piercing-sucking

Key Characteristics: Homoptera have a beak arising from the rear of the head and wings membranous when present. They may or may not have wings. All have sucking mouthparts. When present, there are four wings which are held roof-like over the body and are usually membranous. Cicadas and leafhoppers all have wings. Aphids may or may not have wings and are small, typically with a pair of projections (cornicles) arising from the fifth or sixth abdominal segment. Scale insects are wingless; live on branches, roots and leaves; and move around little, if any, after beginning to feed. The body is covered with a hard or waxy covering. Mealybugs are usually wingless, whitish or gray in color, covered with a waxy substance, and move slowly. Mouthparts arise from the hind part of the head. Leafhoppers, aphids, etc. have many shapes and sizes. Some species in the order Homoptera give birth to living young.

Biology: All Homoptera feed on plants.

Name derivation: Homoptera = Latin for “uniform” (homo); “wings” (ptera).

Neuroptera

Common names: lacewings, antlions, and dobsonflies

Metamorphosis: holometabolous

Mouthparts: chewing

Key Characteristics: Neuroptera have membranous wings with numerous veins, and long antennae. They are rather fragile insects with two pairs of many-veined wings of about the same size. Antennae are long. Chewing mouthparts occur in adults, but some larval mouthparts are modified for grasping and sucking.

Biology: Immature stages are predaceous. Lacewings and their immature forms, known as aphid lions, are the most common insects in this order, and both feed on aphids. Adult green lacewings can be found throughout the year. They are considered beneficial, because they feed on other insects. Immature ant lions are called "doodlebugs", and they form pits in dry, dusty soil.

Name derivation: Neuroptera = Latin for “nerve” or net referring to the many wing veins (neuro); “wings” (ptera)

Coleoptera

Common names: beetles, weevils

Metamorphosis: holometabolous

Mouthparts: chewing

Key Characteristics: Coleoptera have the front pair of wings (elytra) hard and shield-like, meeting in a straight line down the middle of the back. They usually have two pairs of wings. The hind wings are membranous and are folded under the front wings when at rest.

Biology: Immature stages are grub-like or worm-like and the insects pass through a pupal stage before becoming adults. Food habits are varied. Some feed on living plants; some are predaceous; some are scavengers; and some bore in wood. This order includes some of the best-known and most important insect pests. Most of the members are terrestrial, but some are aquatic. Coleoptera is the largest order, including about 1/4 of all known insects or about 280,000 different species. Perhaps the most famous members of this group are lady beetles and the cotton boll weevil.

Name derivation: Coleoptera = Latin for “sheath” (coleo); “wings” (ptera)

Lepidoptera

Common names: butterflies, skippers, and moths

Metamorphosis: holometablous

Mouthparts: siphoning as adults, chewing as larvae

Key Characteristics: Lepidoptera usually have four well developed wings covered with overlapping scales. Mouthparts of the adults are formed for sucking. Immature stages (larvae) are worm-like. Some are known as caterpillars, cutworms or hornworms; and their mouthparts are formed for chewing.

Biology: This is one of the best-known orders of insects and contains some of our most important pests, such as the codling moth, armyworm, clothes moth and cabbageworm. Most of the caterpillars feed on leaves of plants, while others bore in plant stems and still others are leafminers.

Name derivation: Lepidoptera = Latin for “scale” (lepido); “wings” (ptera)

Diptera

Common names: flies, midges, gnats, mosquitoes

Metamorphosis: homometabolous

Mouthparts: piercing-sucking, cutting-sucking, cutting-lapping, and sponging

Key Characteristics: Diptera are usually winged, but have only one pair of wings with few veins. Hind wings are represented by a pair of slender, knobbed structures called halteres that are reduced in size and sensory in function. Mouthparts are formed for sucking or piercing and sucking. Fly larvae are known usually as maggots; they are entirely unlike the adults. Flies occur in many shapes and sizes.

Biology: Diptera is a very important group. The order includes forms that are parasitic, predaceous and others that live on either living or dead plant or animal material. Other members of the order cause much damage to crops. Many harmful flies, such as mosquitoes, spread diseases (such as yellow fever and malaria) and are responsible for millions of human deaths. Because many of the species carry diseases, this is one of the most important orders from the standpoint of human health.

Name derivation: Diptera = Latin for “two” (di); “wings” (ptera)

Hymenoptera

Common names: ants, bees, wasps, sawflies, horntails

Metamorphosis: holometabolous

Mouthparts: chewing, chewing-lapping

Key Characteristics: Hymenoptera have membranous wings with few veins and the front pair larger than the hind pair. Some individuals are wingless. Mouthparts are formed for chewing or for both chewing and sucking. The body is usually constricted greatly between the abdomen and thorax. Immature stages are maggot-like or caterpillar-like and are entirely different from the adults.

Biology: Habits of these insects are varied: some are predaceous, some are parasitic, some cause plant galls, and some feed on plant foliage. Others, such as bumble bees and honey bees eat plant pollen and nectar. This order includes some of our most harmful, as well as some of our most beneficial insects. The abdomen in the females is usually furnished with a stinger. These insects have a painful sting and should be avoided if possible.

Name derivation: Hymenoptera = Latin for “membrane” (hymeno); “wings” (ptera)

Class Arachnida

Common names: ticks, mites, spiders, scorpions, windscorpions and various others

Arachnid characteristics include:

1. A body divided into two parts (cephalothorax and abdomen)

2. Four pairs of legs

3. No antennae

4. No wings

Common Arachnid Orders

Araneae

Common name: spiders

Metamorphosis: The stages are eggs, young (often called spiderlings) and adults.

Mouthparts: Mouthparts are a pair of chelicerae, each with a piercing tooth. Chelicerae are used to manipulate captured prey but all food intake is liquid.

Key Characteristics: Spiders are wingless and lack antennae. Most have six or eight eyes and bodies variable in size and shape. Young and adults have eight legs and a pair of palpi by the mouth. Size ranges from 1/8 inch to more than four inches.

Biology: Palpi are used much like antennae in insects and in males are used during mating. Most spin webs of various sorts to capture prey or as a refuge. All spiders are beneficial predators. A few such as the widow spiders and recluse spiders are poisonous and should be avoided. There are about 900 species of spiders in Texas and only a few are mentioned here.

Name derivation: Araneae

Solifugae

Common name: sunspiders, but also called windspiders, sunscorpions, windscorpions

Metamorphosis: simple - egg, young and adults

Mouthparts: The mouthparts (chelicerae) of windscorpions are formed into large jaws that work vertically and project forward from the mouth. The shape of the head with its enormous jaws is quite distinctive.

Key Characteristics: Windscorpions are 3/8 to 2 inches long. Most are yellowish to brown, and have four pairs of legs. The pedipalps are thin and used like feelers. The first pair of legs are more slender than the others and act as sense organs. The males often have a more slender body, which is often longer than in the females. With their longer legs, males look bigger.

Biology:

Name derivation: Solifugae

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